TOUCH INPUT DEVICE HAVING POWER PROFILING

The present invention is related to material disclosed in the following concurrently filed, copending U.S. patent applications, all of which are assigned to the same assignee as the present invention:

Ser. No. 621,575, "Touch Input Device", filed June 18, 1984; and

Ser. No. 621,585, "Touch Input Device Having Digital Ambient Light Sampling", filed June 18, 1984.

BACKGROUND OF THE INVENTION

The invention relates, generally, to a touch input device and, more particularly, to an opto-matrix frame having automatic corner glare compensation.

Coincident with the use of video displays has always been the problem of the man/machine interface. Traditionally, control of displayed information or cursors has been via a keyboard. Recently, however, a number of devices have been introduced which allow an operator to directly interact with the video display. These types of devices have included light pens, desk-type mouse controllers, or touch input devices such as a switch matrix or opto-electronic matrices. While generally switch-type overlays which are placed adjacent a video display are inexpensive to apply and utilize, they are generally susceptible to contact wear as well as distortion of the video information which is presented to the viewer, particularly in high usage environments. However, since opto-matrix schemes utilize light, which is generally in the infrared region, the switch matrix presented by the light beams is invisible to the viewer and, therefore, does not distort the video information displayed to the viewer and is not subject to wear in high usage environments. A number of schemes which utilize opto-matrix frames may be found in U.S. Pat. No. 4,267,443 "Photoelectric Input Apparatus", issued May 12, 1981 to Carroll et al; U.S. Pat. No. 4,243,879 "Touch Panel with Ambient Light Sampling", issued Jan. 6, 1981 to Carroll et al; and U.S. Pat. No. 3,764,813""Coordinate Detection System", issued Oct. 9, 1973 to Clement et al. These three schemes address problems inherent with opto-matrix devices such as increasing frame resolution without a corresponding increase in components, surrounding or ambient light compensation, or optimization of emitter/detector driving and detecting networks respectively. These systems still have drawbacks in some areas such as large component usage thereby resulting in higher costs, ambient light sensing which is based on a predetermined value rather than dynamically, and difficulty in compensating for reflection or glare which may result in stylii hits not being recorded.

Glare problems generally occur when an emitter is adjacent the corner of the frame or bezel such that light produced by the emitter bounces off an adjacent surface and is then detected by the detector such that any stylus which is introduced to the video display inherently blocks the majoriy of the light received by the detector but the reflectant light is sufficiently high for the detector and its associated circuitry to not perceive a hit. Accordingly, it is desirable to have a device which minimizes the number of components necessary for addressing and detecting emitters and detectors. Further, it is also desirable to have a device which dynamically compensates for ambient light and for variations in emitter output and detector sensitivity. Also, it is desirable to have a device which minimizes glare problems. Such a scheme is taught in the present invention.

It is a principal object of the invention to provide a touch input device having a light beam matrix comprising an opto-matrix frame having a bezel adjacent thereto and a plurality of emitters and oppositely positioned detectors disposed in said frame characterized in that the optical power of at least one emitter and/or optical sensitivity of a detector is decreased with respect to the remainder of the emitters and detectors thereby minimizing the effects of radiant energy which is reflected by said bezel.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is now made to the accompanying drawings in which:

FIG. **1** is a representative view of an operator utilizing a video display;

FIGS. **2**, **3** and **4** form a complete schematic diagram for use in conjunction with the touch input entry device of the present invention;

FIG. **5** is a representational view of glare produced by the frame surrounding the opto-matrix devices as well as a numbering assignment of the emitters and detectors of the present invention;

FIGS. **6** through **11** are flow chart diagrams for use with the preferred embodiment of the present invention; and

FIG. **12** is a timing diagram of the data output for use with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT CONSTRUCTION OF THE PRESENT DEVICE

Referring now to FIG. **1**, there is illustrated a representative view of an operator utilizing a video display. Shown is a CRT **10** having a display area **12** and which generally interacts with a keypad or keyboard **14**. An operator **16** interacts with the display area **12** through the use of the stylus **18**, which in the preferred embodiment of the present invention, is the finger of the operator thereby presenting a truly touch-type interactive system. It is to be understood, however, that other types of stylii can and may be used without departing from the spirit and scope of the present invention such as, for example, pencils, pointers, or other similar types of apparatus. While the keypad **14** is shown, it is one of the primary objects of the present invention to utilize the keypad **14** as little as possible, if at all, with the operator **16** utilizing the stylus **18** for direct interaction with the CRT. A touch input area is generally defined by what the operator **16** sees in the display area **12**. In the preferred embodiment of the present invention, this touch area utilizes emitters which are disposed on the bottom and one side of the display with detectors located on the top and opposite side thereby forming an infrared light beam matrix (shown more clearly in FIG. **5**). The light beams (not shown) shine through the bezel **20** which is disposed around the edge of the CRT **10** and which, in the preferred embodiment of the present invention, is opaque to visible light but transparent to infrared light. It is to be understood, however, that other types of bezels which exhibit different types of light transmission properties may be utilized.

Referring now to FIGS. **2**, **3** and **4**, there is illustrated a schematic for the present invention. A list of the major